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(54) Metal-plastic cartridge case and cartridge arrangement

(57) A cartridge case and cartridge arrangement in which a metal base 13 is joined along an annular intermating chevron-shaped joint with a glass-reinforced plastic sleeve 15. The case has a propellant, projectile, and a percussive primer. A plurality of circumferentially spaced vent holes 17 are formed in the plastic sleeve along a portion of the chevron joint as an aid to reducing excessive interface friction loads at the chevron joint during firing of the cartridge.

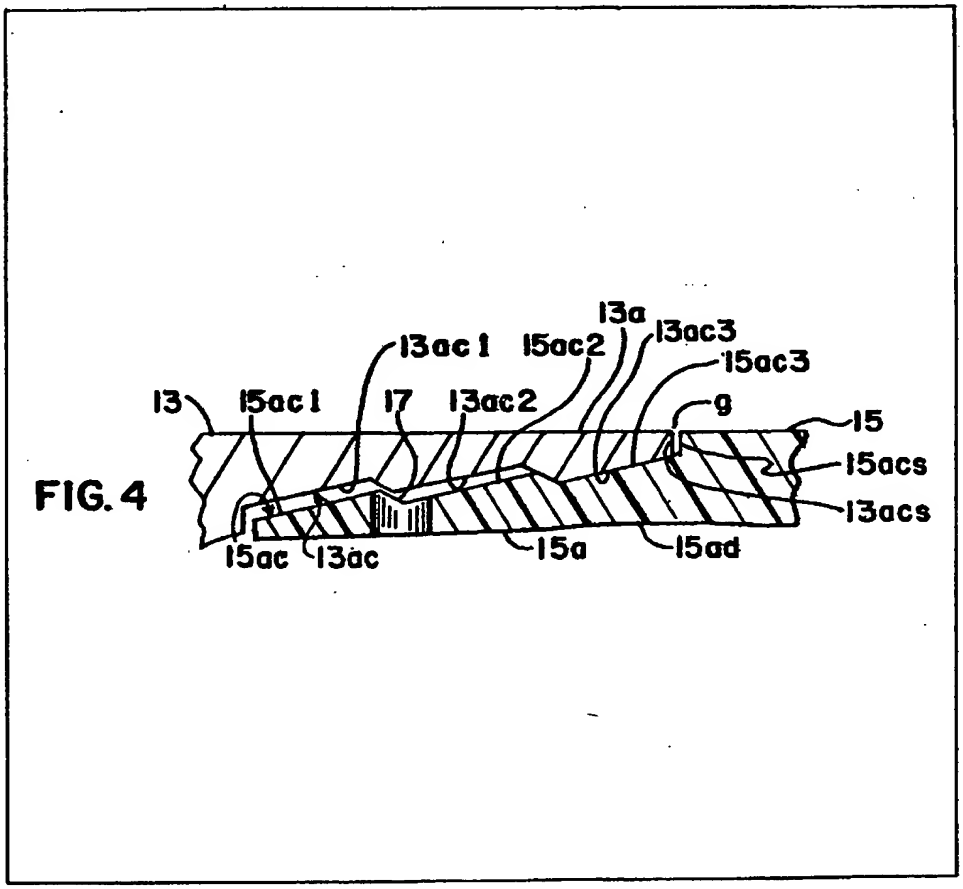

FIG. 4

The drawings originally filed were informal and the print here reproduced is taken from a later filed f rmal copy.

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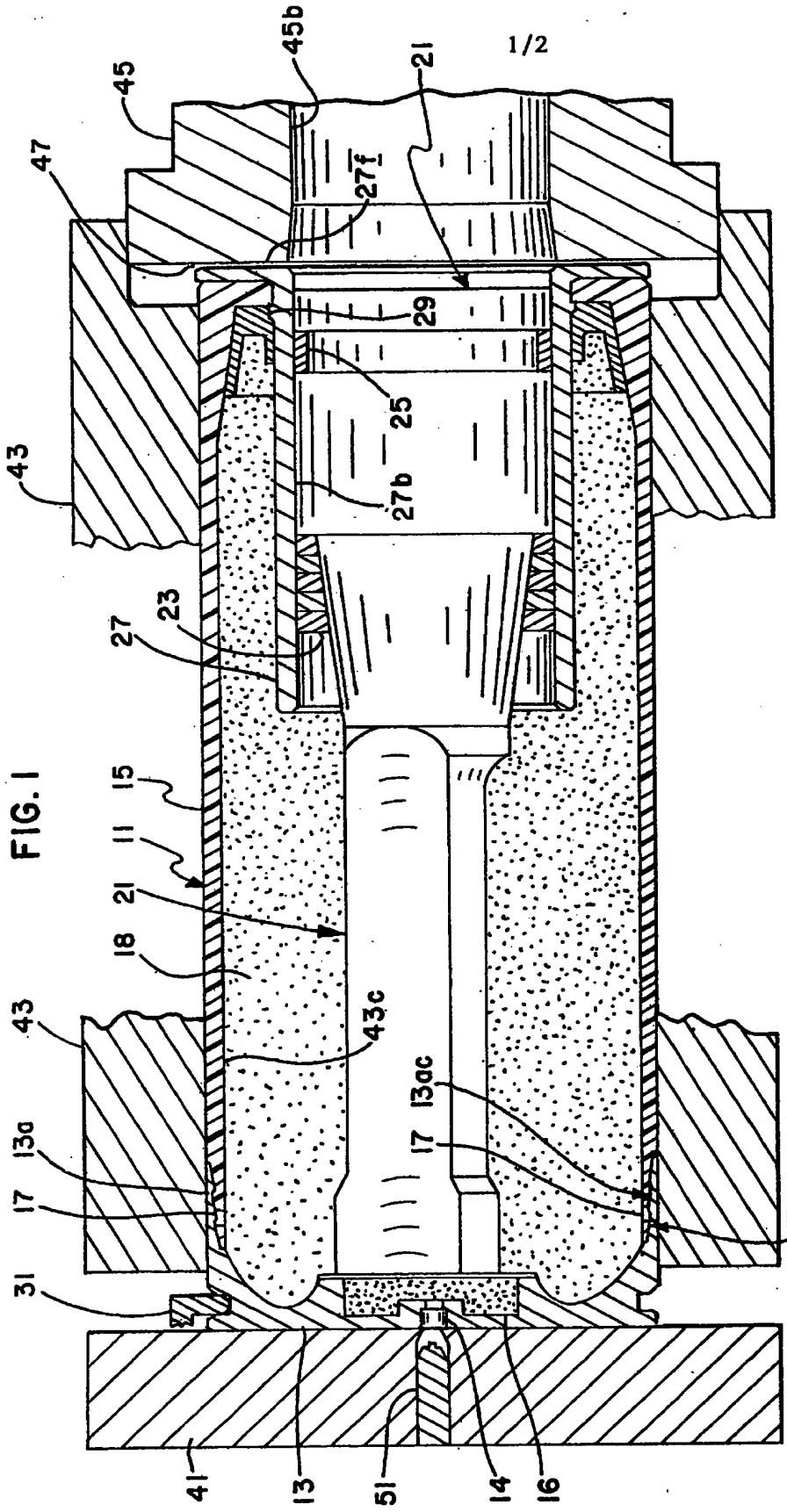

FIG. 1

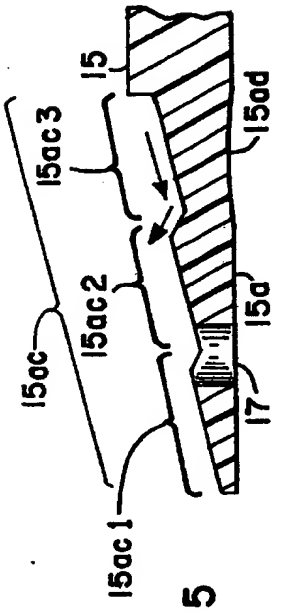

FIG. 5

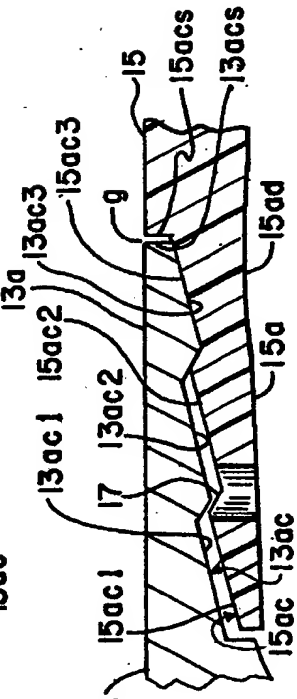

FIG. 4

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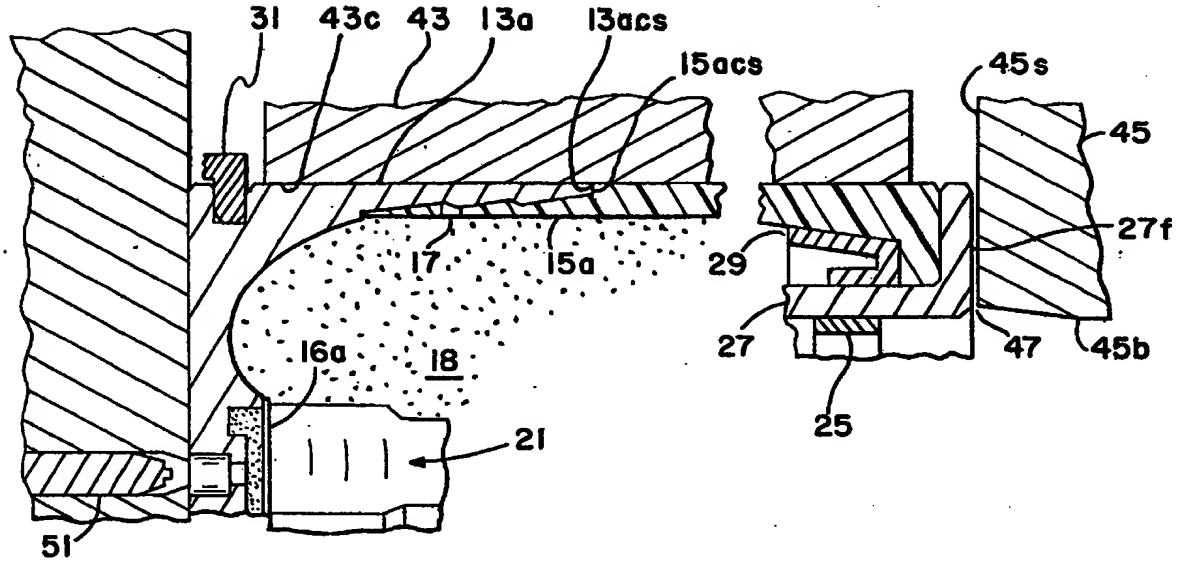
FIG. 2


31
43c
43
13a
13acs
15acs
45s
45
27f
29
17
15a
27
47
45b
16a
18
25
21
51

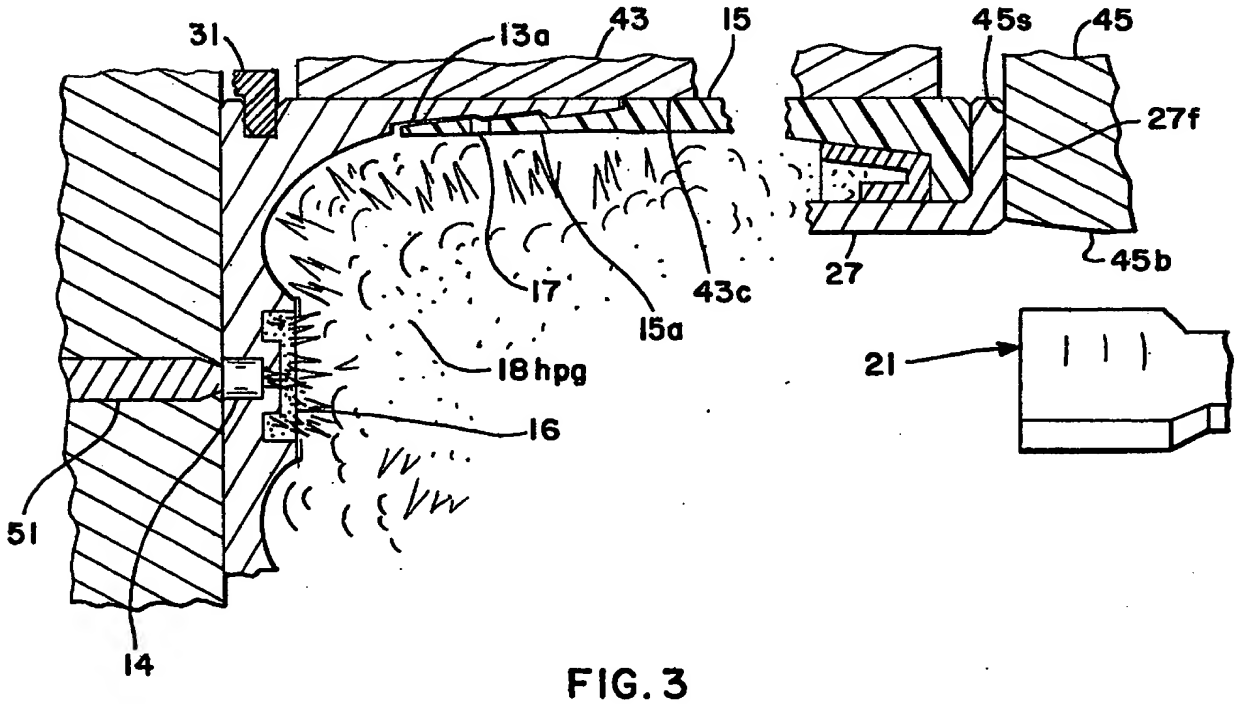

31
13a
43
15
45s
45
27f
27
45b
17
43c
15a
21
18hpg
16
51
14

FIG. 3

SPECIFICATION

M tal-plastic cartridge case and cartridge arrangement

This invention relates to a cartridge case having a metal base and a plastic sleeve connected through an interference joint formed thereby, and to a cartridge arrangement incporporating such case.

It is desirable to provide a combined plastic sleeve and metal base cartridge case and cartridge arrangement. However, the joint therebetween creates substantial problems in that such joints tend to fail under firing loads. It has particularly been found that in some important practical firing conditions where relatively large length wise expansion of the cartridge case can occur, such as where the propellant gas pressures cause the breech block and/or other portions of the cartridge chamber to yield and expand the firing chamber lengthwise and/or where the firing chamber has an initial large headspace enabling length wise expansion of the case during firing, an otherwise normally successful interference joint will fail in the plastic sleeve section due to excessive interface friction along the mating joint surfaces.

In accordance with the invention there is provided a cartridge case comprising a base, a sleeve connected to said base through a mechanical interlocking overlapping joint which forms an obturating seal under radially outward pressure exerted thereon, and a plurality of circumferentially spaced radially extending vent holes formed in the radially innermost of the overlapping portions of said joint to enable partial pressure equalization along a longitudinal portion only of said joint while enabling obturating circumferential sealing of the remaining portion of said joint.

The invention will be described with reference to the accompanying drawings, in which:

Figure 1 is a longitudinal section view of a cartridge case and cartridge according to the invention, showing such in a cartridge chamber preparatory to firing.

Figure 2 is a fragmentary view of the cartridge and chamber similar to Figure 1, likewise preparatory to firing.

Figure 3 is a fragmentary view of the cartridge and chamber, illustrating schematically the action of the various parts during firing and resultant propellant gas pressurization.

Figure 4 is an enlarged fragmentary section view of the chevron joint, schematically illustrating the venting and friction relieving action of the vent holes along a portion of the joint during firing.

Figure 5 is an enlarged fragmentary section view of the plastic sleeve portion of the chevron joint showing the zone of interface frictional loading and sealing during firing and the friction-relieving action effected by gases passing through the friction-reducing vent holes.

Referring now in detail to the Figures of the drawings, in the illustrative embodiment cartridge 11 has a metal-plastic cartridge case formed of a metal base 13, a suitable metal being steel, brass, nickel, etc. and a plastic sleeve, suitable plastic materials being glass-reinforced nylon, polycarbonate, acetal resin or the like.

A projectile 21 of suitable desired configuration other desired main propellant charge 18 is ignitable by a conventional percussive or other desired primer 14 which is provided for igniting the main propellant charge, the illustrative example including an intermediate black powder charge 16 which may have a frangible cover 16a thereon.

In the illustrative embodiment the nose end of the projectile 21 is carried in a steel sleeve 27 within the bore 27b of which it rides during exit from the case 13, 15. Sleeve 27 has a radially extending end flange 27f which is pressed forwardly against the rear face of the weapon barrel 45 upon firing of the cartridge 11, and an annular obturating case seal 29 is provided to seal the propellant gases during the firing action. The nose end of the illustrative projectile is provided with a bore-riding nylon sleeve 25 and a multiple ring seal 23 which wedges along the tapered projectile surface to effect a seal with the bore 27b initially and subsequently with the barrel bore 45b.

The cartridge 11 is shown chambered in a firing chamber 43c formed in a firing chamber block 43, and removably secured in place by a pawl 31, with a breech block 41 through which a suitable firing pin 51 moves to percussively engage and fire the primer 14 and the propellant powder charges 16, 18.

The cartridge 11 as seated in the firing chamber 43c may or may not have an initial head space gap of significant size at the front and/or rear end of the cartridge 11 between the cartridge and either or both of the barrel rear shoulder 45s and the breech 41, and/or the breech block structure may itself permit a significantly large head space charge to be effected, and thereby effectively elongating the firing chamber, during firing and under the pressures of the propellant gases acting on the opposite end sections 13 and 15, 27 of the projectile. As a result the metal base 13 and plastic sleeve 15 are moved in opposit directions by the combined amount of any initial head space and the increase in head space through elongation of the firing chamber 43c under the pressures exerted during firing of the propellant charges 16, 18 to propel the projectile from the cartridge case and along the barrel bore 45b.

To this end it is desirable to provide a joint between the metal base 13 and the plastic sleeve which will not only withstand handling loads and acceleration loads during firing, but also will enable the relative longitudinal expansion movement between the metal base 13 and nylon sleeve 15 during firing without rupture or separation, while still effecting a sealed joint both prior to and during firing.

As an illustrati n of the overall head spac which may be required to be acc mmodated, in

one chamber of approximately 13.25 inches length a h ad space charge f approximately .120 inch has been encountered.

T this end, it is important to minimize the incidence of failure at the metal base-plastic sleeve joint under these practical operating conditions where such may occur, and the present invention is directed to accomplish this object and purpose.

The metal base 13 is joined to the plastic sleeve 15 through an annular chevron joint which provides both good handling and acceleration load strength while providing an effective obturating gas seal during firing. In addition the joint enables frictional relief or reduction along a substantial extent of its length during firing to thereby enable the joint to accommodate the relative frictional sliding movement between the base 13 and sleeve 15 for head space accommodation and thereby minimizing the otherwise substantial likelihood of separation failure at the joint.

The chevron joint is formed by two annular interfacing intermating complementary annular step-like chevron surfaces 13ac and 15ac formed respectively on the forwardly facing rim lip 13a of the metal base 13 and the rear end surface 15a of the plastic sleeve 15. The chevron surfaces 13ac and 15ac are also generally tapered, and the plastic chevron section 15ac is the radially inboard one of the two sections, thereby enabling the plastic section to be obturated and into sealing relation with the stronger less yielding metal band therearound as formed by the inwardly facing chevron section 13ac of the metal base rim. In the assembled condition prior to firing the joint is mechanically stable and forms a secure mechanical interlocking connection. In addition, as above noted, the tapered inner chevron section 15ac will be obturated radially outwardly into continuing sealing contact with the metal base chevron section 13ac under the forces of the propellant gas pressures during firing of the cartridge 11 and propulsion of the projectile 21.

However, due to the problem of the requirements for accommodating initial and/or increase of head space in the firing chamber upon firing of the cartridge, the chevron joint has very substantial longitudinal tensile stresses exerted thereon, which desirably are accommodated by permitting longitudinal slippage along the chevron joint intermating sufaces. With the chevron joint as simply above-described the interface friction along the entirety of the length of the chevron surfaces 13ac and 15ac is so great as to seriously approach or exceed the strength of plastic materials, including those reinforced with glass or other suitable fibers. This problem is minimized by providing a polurality of radial vent holes 17 in the zone of the chevron surface 15ac spaced sufficiently away from the chevron zone 15ac3 as to enable it to maintain an obturating seal with the corresponding chevron surface 13ac3 of the metal base chevron section 13ac, while enabling pressure equalizing passage of the pressurized propellant gases through the vent holes 17 t thereby relieve the friction forces along the adjoining chevron surface sections 13ac1, 13ac2 and 15ac1, 15ac2. The total effect is to materially reduce the friction and mechanical surface area, and thereby reduce the resistive forces opposing sliding expansion of the chevron joint during firing, and to thus enable a substantially greater assurance of maintaining not only an effective gas seal at the joint but also to maintain the structural integrity and reduce the likelihood of failure of the case at this zone.

The action of the vented chevron joint 13ac, 15ac is shown schematically in enlarged form in Figure 4, the venting separation action being exaggerated for clarity of illustration. Figure 5 illustrates the zone of resultant obturating seating 15ac3 and normal frictional and mechanical locking resistance to relative longitudinal sliding separation movement between the base 13 and the sleeve 15 during firing.

It will be noted that the vent holes are shown as being approximately midway of the two chevron sections 15ac1 and 15ac2. The illustration in Figure 4 shows schematically the radial deformation at 15ad of the plastic sleeve 15 which results from obturating deformation of the sleeve 15 outwardly against the metal base in the zone of sealing chevron zones 13ac3, 15ac3. Likewise, Figure 4 schematically shows the resultant elongation movement positioning of the base 13 and sleeve 15 joint sections 13ac, 15ac, resulting in a gap into which a small radial obturating convex deformation of the sleeve 15 may occur, as shown.

It will thus be appreciated that a metal-plastic cartridge case and cartridge construction is provided which not only provides a good interface joint seal which has strength for withstanding handling and acceleration loads, but also has provision for automatically reducing the joint interlock resistive action during firing, and this minimizes and materially reduces the likelihood of joint failure during firing, where large head space expansion is involved.

While the invention has been illustrated and described with reference to a single illustrative example, it will be apparent that various modifications and improvements may be made without departing from the scope or spirit of the invention. Accordingly, it is to be understood that the invention is not to be limited by the particular illustrative embodiment, but only by the scope of the appended claims.

CLAIMS

1. A cartridge case comprising a base, a sleeve connected to said base through a mechanical interlocking over-lapping joint which forms an obturating seal under radially outward pressure exerted thereon, and a plurality of circumferentially spaced radially extending vent holes formed in the radially innermost of the verlapping portions of said joint to enable partial pressure equalization along a longitudinal portion only of said joint while enabling obturating

circumferential sealing of the remaining portion of said joint.

2. A cartridge case according to Claim 1, in which the base if formed of metal and the sleeve is formed of a plastic material.

3. A cartridge case according to Claim 2, in which the sleeve is formed of a fiber-reinforced cured plastic resin.

4. A cartridge case according to any one of the preceding claims, in which the mechanical interlocking overlaping joint comprises overlapping interfacing annular chevron surfaces formed on each of the base and the sleeve, the vent holes being formed in the zone of and extending through the outwardly facing innermost one of said chevron surfaces.

5. A cartridge case according to Claim 4, in which the base has a longitudinally extending annular rim or lip, a portion of which has formed thereon one of the interfacing annular chevron surfaces forming the joint.

6. A cartridge case according to Claim 5, in which the bas rim or lip is tapered at its end zone, and the chevron surface is formed along said tapered end z ne, the interfacing sleeve chevron surface being complementarily tapered.

7. A cartridge case according to Claim 6, in which the sleeve is disposed radially inboard of the base in the zone of the joint and has its chevron surface facing radially outwardly and having the vent holes formed therein.

8. A cartridge case substantially as hereinbefore described and as illustrated in the accompanying drawings.

9. A cartridge comprising a cartridge case according to any one of the preceding claims, a projectile carried by said case, a propellant powder charge disposed within said case, and means for igniting said propellant powder charge.

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